



**UNIVERSITY OF ALBERTA**  
**FACULTY OF MEDICINE & DENTISTRY**  
Department of Anesthesiology & Pain Medicine

# **ABSTRACTS**



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#### **BNP as a Screening Tool for Myocardial Infarction and Myocardial Injury after Noncardiac Surgery**

Varun Suresh BSc, MD, PGY-41, Michael R. Taylor MSc1, Albert Tsui PhD, FCACB2, Derek Dillane MB BCh BAO, MMedSci, FCARCSI

1Department of Anesthesia, University of Alberta, Edmonton, Canada

2Department of Laboratory Medicine, University of Alberta, Edmonton, Canada

**Background:** Major cardiac complications are responsible for at least a third of perioperative deaths and are associated with significant morbidity(1-3). Canadian Cardiovascular Society (CCS) Guidelines on Perioperative Cardiac Risk Assessment identifies B-type natriuretic peptide (BNP)  $\geq 92$  ng/L as an independent predictor of myocardial infarction (MI)(4). CCS guidelines recommend screening with preoperative BNP and measuring daily high-sensitivity troponin I (hsTnI) up to 72 hours after surgery when BNP  $\geq 92$  ng/L. Without this screening, more than half of all perioperative MIs go undetected(4,5), and is termed myocardial injury after non-cardiac surgery (MINS)(5). It is defined as troponin T  $\geq 0.03$  ng/ml(4) and has been associated with significantly increased 30-day mortality(6). The objectives of this study were to compare rates of MI within 30 days of surgery in BNP-positive and negative patients, to determine the incidence of MINS within 72 hours of surgery in BNP positive patients.

**Methods:** Research Ethics Approval was granted, and the study was registered at clinicaltrials.gov (NCT04077294). Patients undergoing elective, noncardiac surgery with an overnight stay were assessed at the Preadmission Clinic. BNP screening was performed in qualifying patients, and those with positive BNP underwent daily hsTnI testing. All patients were contacted by telephone at 30 days to determine incidence of MI. Medical records were reviewed if patients had an MI or MINS. Fischer's exact test was used for data analysis.

**Results:** 1348 patients were screened between May 21st and September 12th, 2019. 21.3% (287/1348) of patients qualified for BNP measurement. 24.3% (70/287) of patients had positive BNP. The incidence of MI for BNP positive patients was 2.2% (1/70) and in BNP negative patients was 0.5% (1/217). This was not statistically significant ( $p=0.429$ ). 25 patients were excluded because low sensitivity troponins were measured postoperatively, leaving 262 patients for analysis. 13.3% (6/45) of BNP positive patients had MINS within 72 hours of surgery and none of them had an MI or died.

**Conclusion:** Preoperative BNP screening of at-risk patients undergoing noncardiac surgery was not found to be a valuable tool for predicting risk of postoperative MI. We found preoperative BNP screening was useful for detecting patients at risk of MINS, but was not associated with increased cardiac morbidity or mortality.



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#### Evaluating the Stability of Remifentanyl Once Reconstituted With Normal Saline in Polyvinyl Chloride Bags

Taylor Bucyk BSc, MD, PGY-51, Ariane Fielding MD, FRCPC1, Anna Taylor, BSc, PhD2, Rakesh Sondekoppam MBBS, MD3

1Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, Alberta, Canada

2Department of Pharmacology, University of Alberta, Edmonton, Alberta, Canada

3Department of Anesthesia, University of Iowa Carver College of Medicine, Iowa City, Iowa, USA

**Background:** Remifentanyl, a potent synthetic opioid, is reconstituted and diluted to the desired concentration. The manufacturer recommends that reconstituted remifentanyl should be disposed of after 24 hours, yet limited data exists regarding the drug's long-term stability. Bevans-Warren et al. showed that remifentanyl mixed to 100µg/mL in plastic syringes stored at room temperature (RT) is stable at 45 days<sup>1</sup>. Here, we investigate the stability of remifentanyl diluted to 10µg/mL in 0.9% sodium chloride PVC bags at both RT and 4°C over 30 days.

**Methods:** 1mg remifentanyl vials were reconstituted with 1mL of sodium chloride 0.9% and then diluted to 10µg/mL in 100mL 0.9% sodium chloride PVC bags. Bags were stored at either RT (23-25°C) or 4°C (3 bags per group). 1mL aliquots were collected for analysis at 0 hours, 24 hours, 48 hours, and 30 days and frozen at -80°C. Samples were analyzed via liquid chromatography with tandem mass spectrometry (LC/MS/MS). Chromatogram peak areas were used to determine the concentration of remifentanyl in each sample. Data was analyzed using mixed effects modelling (restricted maximum likelihood approach) for within group and between group comparisons with time and temperature as factors. Percent remifentanyl degradation was calculated with the starting concentrations as the baseline. The product was deemed stable if there was <10% degradation<sup>2</sup>.

**Results:** The reconstituted remifentanyl showed a significant difference in measured concentrations in both groups over time ( $p=0.001$ ). There was also a significant difference in measured concentrations at baseline [MD (95% CI): 0.017 (0.005, 0.03)] ( $p=0.007$ ) but not at other time points between group comparison. The percentage decline in remifentanyl concentration was significantly higher at 30 days in RT (-22.47%) compared to 4°C (+5.6%), but not at 24 or 48 hour timepoints where they did not show any significant degradation (RT: 24h +19.40%, 48h +5.25%; 4°C: 24h +8.85%, 48h +4.19%).

**Conclusions:** Mixing of remifentanyl by the anesthesiologist may result in inaccurate baseline concentrations when employing routine reconstitution methods. Reconstituted remifentanyl stored at room temperature may show similar stability to that stored at 4°C but showed significant degradation when stored long term (30 days). This has important environmental and economic implications to practice<sup>3</sup>.



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#### **Adductor Canal Blocks: QI Audit at Royal Alexandra Hospital Orthopedic Surgery Centre**

Sean Goos, BSc, MD, PGY-51; Ferrante S. Gragasin, MD, PhD, FRCPC1

<sup>1</sup>Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, AB.

**Introduction:** The adductor canal block (ACB) is a peripheral nerve block that, through blockade of the saphenous nerve, can be utilized as an adjunct for analgesia for several different types of knee operations. The objective of this study is, via a retrospective case analysis, identify various outcomes measures related to single-shot adductor canal blocks performed during knee arthroplasty at the RAH OSC.

**Design and Methods:** We performed a retrospective case analysis, looking at two hundred knee arthroplasty operations performed at the RAH between July, 2017 and April, 2019. 101 reviewed cases did not have an ACB performed, while 98 reviewed cases did have an ACB performed. Various data points were extracted from the charts, and comparisons were made between the two subsets of this knee arthroplasty population.

**Outcome Measures:** The primary outcome measure obtained was total amount of opioid use intraoperatively, during post operative day 0, and total use for the duration of their hospital stay. Secondary outcome measures were total length of hospital stay, time from operation to first physiotherapy intervention, maximum resting pain scores measured on each respective post operative day, use of antiemetics, total number of overnight nursing interventions in these patients, and surgical use of a peri-articular injection at the conclusion of surgery.

**Results:** The primary outcome measure of opioid use perioperatively showed no significant difference between the two groups. For our secondary outcome measures, the group that had an ACB block performed showed a significant reduction in terms of acetaminophen use ( $p < 0.01$ ), number of required overnight nursing interventions ( $p=0.0003$ ), length of stay in hospital ( $p=0.049$ ), and maximum self-reported pain scores on POD 0 ( $p = 0.0002$ ).

**Conclusions:** Prior literature suggests the the ACB is not-inferior, to a femoral nerve blockade, in terms of pain control and opioid consumption in the post-operative period. Our retrospective study was able to show some benefit in terms of important secondary outcome measures such as self-reported pain scores, length of stay in hospital, and overnight nursing interventions required. This suggests there may be benefit in terms of continuing this practice for total knee arthroplasties.



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#### Surgeon-Initiated Rectus Sheath Catheter Using Catheter-Over-Needle Assembly for Open Urological Surgeries: A Case Series

Jaasmit Khurana MD,<sup>1</sup> Vivian H Y Ip MBChB FRCA<sup>2</sup>

<sup>1</sup>Resident physician (Department of Anesthesiology and Pain Medicine), University of Alberta Hospital, Edmonton, Alberta, Canada.

<sup>2</sup>Associate Clinical Professor (Department of Anesthesiology and Pain Medicine), University of Alberta Hospital, Edmonton, Alberta, Canada.

**Importance:** Regional anesthesia for major urological surgeries is an effective opioid-sparing adjunct. A paucity of studies, however, have investigated the analgesic benefits of surgeon-initiated rectus sheath blocks (SIRSBs), using catheter-over-needle (CON) assemblies.

**Objective:** This case series of five patients documents the postoperative pain course in those who received SIRSBs using CON assemblies for open urological surgeries.

**Design:** Intraoperative analgesia was provided at the anesthesiologist's discretion. Bilateral RSBs using CON assembly were inserted and 20 mL 0.25% bupivacaine bolused through each catheter by the urologist prior to abdominal closure. Postoperatively, 15 mL 0.2% ropivacaine was bolused via RSB catheters every 4 hours. In addition, patient-controlled analgesia (PCA) with hydromorphone and regular acetaminophen were provided.

**Results:** Demographic data (5 patients): age  $72.0 \pm 4.69$  years, 2 females, BMI  $30.3 \pm 4.54$ . Three patients underwent nephroureterectomy, 1 underwent cystectomy and the other cystoprostatectomy. Pain scores (NRS) out of 10, at rest and movement, were  $4.6 \pm 2.8$  in PACU and reduced by half at rest ( $2.4 \pm 0.49$ ) at 24 hours post-operatively. At 48 hours post-operatively, the average NRS further reduced to  $1.8 \pm 0.98$  at rest and  $4.4 \pm 1.0$  on movement. The IV HM consumption was  $7.2 \pm 4.7$ mg and  $6.2 \pm 1.6$ mg at the 24- and 48-hour postoperatively, respectively. There were no catheter related complications (ex. Leak, dislodgement, premature removal). All patients ambulated by POD-1 and tolerated oral fluids by POD-2. There were no incidences of N/V.

**Case Reports:** Two cases highlight advantage of SIRSBs to reduce opioid consumption, while the other showcases the importance of monitoring during LA infusion. A healthy, 66-year-old female underwent an open radical nephroureterectomy and experienced hallucinations on POD-1 and POD-2 evening. These opioid-related side effects completely resolved once PCA was stopped while LA infusion continued. Another patient, a 72-year-old male, underwent the same procedure and experienced metallic taste 12 hours post-op, a possible sign of LA systemic toxicity. LA administration was held for 5 hrs until symptom resolution and then restarted with no further ill effects.

**Conclusions and Relevance:** This case series shows successful implementation of SIRSBs using CON assembly as analgesic adjunct to enable reduction of opioid consumption for open urologic surgeries. CON technique shows no catheter related complications but diligent monitoring during LA infusion is essential.



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#### **Polypharmacy: A Flag for High-Risk Emergency Surgery Patients**

Melissa S. Shears, MD1; Daniel I. McIsaac, MD, MPH, FRCPC2,3; James S. Green, MBBS1, FRCA, Xiaming Wang, PhD4; Rachel G. Khadaroo, MD, PhD, FRCSC5,6

1Department of Anesthesiology and Pain Medicine, University of Alberta

2Department of Anesthesiology and Pain Medicine, University of Ottawa

3 School of Epidemiology and Public Health, University of Ottawa

4Aberhart Centre, Research Facilitation, Alberta Health Services

5Department of Surgery, University of Alberta

6Department of Critical Care Medicine, University of Alberta

**Purpose:** Polypharmacy ( $\geq 5$  medications) is associated with adverse outcomes and is more common with increasing age. This study aimed to determine the impact of pre-hospital polypharmacy on postoperative outcomes in older patients undergoing emergency general surgery (EGS). Additionally, this study aimed to compare the predictive value of polypharmacy alone to the Comorbidity Polypharmacy Score (CPS)[1].

**Methods:** A secondary retrospective analysis of the prospective, non-randomized, controlled before-and-after study Elder-Friendly Approached to the Surgical Environment (EASE) was completed. This study included patients  $\geq 65$  years presenting for EGS in 2 tertiary care hospitals in Alberta, Canada from 2014-2017. Primary outcomes evaluated were survival at 30-day and 6-months. Secondary outcomes included postoperative complications, length of stay (LOS), and readmission. Outcomes were estimated using multivariable analysis, adjusting for clinically relevant covariates including age, sex, body mass index, race, and surgical procedure. A concordance index (c-index) analysis was conducted to compare discrimination of polypharmacy vs CPS models on survival.

**Results:** All patients (N=684) from EASE were included in this study. Polypharmacy was present in 321 (46.9%) of patients. Compared to those without polypharmacy, both 30-day and 6-month mortality was significantly higher in the polypharmacy group (6.9% vs 1.7% and 11.5% vs 4.4%, respectively,  $p < 0.001$ ). After adjusting for covariates, polypharmacy was associated with lower survival at 30 days and 6 months (HR 2.70, 95% CI 1.07 to 6.80;  $p = 0.03$ , and HR 2.07, 95% CI 1.14 to 3.75;  $p = 0.02$ , respectively). Patients with polypharmacy had higher odds of postoperative delirium (OR 2.05, 95% CI 1.35 to 3.10;  $p < 0.001$ ), increased LOS (RR 1.20, 95% CI 1.05 to 1.36;  $p = 0.01$ ), and readmission (RR 1.20, 95% CI 1.05 to 1.36;  $p = 0.05$ ). There was no difference in discrimination between the CPS and polypharmacy alone in predicting postoperative survival at both 30-days and 6-months.

**Conclusions:** Polypharmacy is common in older patients undergoing EGS and is associated with adverse postoperative outcomes. Screening for polypharmacy is a simple and objective approach to identifying high-risk older EGS patients. The CPS may not add any additional prognostic benefit over screening for polypharmacy alone.

**References:** 1. Evans DC, Gerlach AT, Christy JM, et al. Pre-injury polypharmacy as a predictor of outcomes in trauma patients. *Int J Crit Illn Inj Sci.* 2011;1(2):104-9.



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#### Quality Improvement Project - Implementation of a New ICU Handover Protocol

Presented By: Ronald Lima

Additional Authors: Jocelyn Slemko, Dennis Djogovic, Michael Hogan

**Introduction:** Healthcare related adverse events are unfortunately quite frequent. The fact is that healthcare delivery has become more elaborate over the past several decades. Multidisciplinary teams, complex medical equipment and use of multiple drugs, are links in a chain that can easily break if proper training and protocols are not in place. One particularly fragile link is handover of patients from one team to another. At our institution, a non standardized handover has been identified to be practiced when transferring patients to ICU care. Failure to disclose and/or record significant information can be linked to critical incidents and ultimately, adverse outcomes. Our objective is to implement and perpetuate a protocol to minimize loss of critical information and improve patient safety.

**Design and Methods:** Using the model for improvement, a new protocol has been proposed. It comprises a standardized handover tool that has been developed plus the requirement of the presence of all multidisciplinary team during transfer of care. The tool has two different sheets, one from ICU to Anesthesia and the other from Anesthesia/Surgery to ICU. These sheets compile basic information about anesthesia technique, intraoperative events, surgical procedure as well as physiological variables. Using a PDSA (plan, do, study, act) cycle, the new protocol has been recently implemented.

**Intervention(s) and Outcome Measures:** The aim is to have 100% of patients handed over from the OR team to the ICU team using the new protocol within 3 months. At first, feasibility and adherence to the new protocol will be checked through ICU nurses experience. Subsequently, changes will be made accordingly, to make the process as consistent and efficient as possible. In a second stage, critical incident data will be retrieved and compared to the period before implementation.

**Results:** Information about the number of standardized handovers performed and Critical incident data will be gathered. The latter refers to patient transfer issues, intraoperative events or procedural complications; medication, fluids and blood products administration issues.



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#### **Impact of Aerosol Box on Intubation During COVID-19: A Simulation Study Of Normal and Difficult Airways**

Sunny Fong, Elliott Li, Efreem Violato, Andrew Reid, Yuqi Gu

**Purpose:** Patients with coronavirus disease (COVID-19) are at risk of requiring mechanical ventilation and concerns of protecting healthcare workers during aerosol-generating medical procedures has led to the design of the aerosol box.

**Methods:** We conducted a randomized crossover mannequin-based simulation study to compare airway management with and without the aerosol box. Thirty-five anesthesiology participants and three critical care participants with more than 50 intubations with videolaryngoscopes were recruited. There were four airway simulations with and without the aerosol box (normal, pharyngeal swelling, cervical spine rigidity, and tongue edema). Each participant intubated the mannequin in eight consecutive simulations. The primary outcome of the study was time to intubation. Secondary outcomes included intubation attempts, optimization maneuvers, and personal protective equipment breaches.

**Results:** Mean (standard deviation [SD]) time to intubation overall with the box was 30.9 (23.0) sec, while the time to intubation without the box was 25.1 (12.2) sec (mean difference, 5.8; 95% confidence interval [CI], -2.9 to 14.5). For the normal airway scenario, the mean (SD) time to intubation was 18.6 (3.5) sec for no box and 20.4 (3.3) sec for box (mean difference, 1.8; 95% CI, 0.2 to 3.4). During difficult airway scenarios only, the time to intubation was 34.4 (25.6) sec with the aerosol box and 27.3 (13.2) sec without the aerosol box (mean difference, 7.1; 95% CI, -2.5 to 16.7). There were more intubation attempts, personal protective equipment breaches, and optimization maneuvers during use of the aerosol box.

**Conclusions:** In this mannequin-based simulation study, the use of the aerosol box increased the time to intubation in some contexts but not others. Further studies in a clinical setting should be conducted to make appropriate modifications to the aerosol box to fully elicit its efficacy and safety prior to implementation in airway guidelines for managing patients with COVID-19.



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#### Evaluation and Improving Adherence to Guidelines for Postoperative Nausea and Vomiting Prophylaxis

Francesca Seal PGY-2, Michael Varro FRCPC, Heather Ting FRCPC

**Background:** Post-operative nausea and vomiting (PONV) affects approximately 30% of patients within 24 hours of surgery. Preventing PONV has been shown to increase patient satisfaction, reduce stay in the post-anesthetic care unit (PACU), and reduce costs. The American Society of Enhanced Recovery and Society for Ambulatory Anesthesia published the fourth iteration of their consensus guidelines on management of PONV in August 2020 with the recommendation that the number of antiemetics administered for PONV prevention be determined by risk stratification.

**Objective:** The primary object of this project is to reduce the rate of PONV at the University of Alberta Hospital.

**Hypothesis:** Providing anesthesiologists with data on their individual PONV management will improve the use of PONV prophylaxis and therefore reduce the rate of PONV.

**Methods:** A pre-intervention retrospective review of approximately 500 charts from adult patients undergoing elective general anesthesia at the University of Alberta Hospital from October to December 2020 will be performed to determine the baseline rate of PONV in PACU and the rate of adherence to the PONV prophylaxis recommendations in the latest guidelines. Anesthesiologists who performed an included case in the study period will receive an email with the collective baseline results and educational materials from the PONV guidelines. All anesthesiologists who do not opt-out will subsequently receive a confidential email with their individual baseline results. A post-intervention chart review will be performed to determine if there has been any change in the rate of PONV in PACU or in the rate of adherence to the recommendations for PONV prophylaxis. The collective and individual data from the post-intervention chart review will again be shared via email.

**Limitations:** The evaluation of PONV will be limited to PACU and will not account for patients who first experience PONV after discharge from PACU. When PONV is not documented, antiemetic administration will be used as a surrogate marker for PONV in PACU. Evaluation of adherence to the guideline recommendations may be limited by incomplete documentation of PONV risk factors.



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#### Postoperative Pain Audit after the Introduction of Erector Spinae Plane Blocks in Elective Cardiac Surgery Patients

Dr Daniela Marsicano: BCom, MBChB, FCA, MMed, FRCPC  
Additional Authors: Dr Wing Lam: BSc, MPH, MD, FRCPC,  
Dr Gerry van Rensburg, MD, FCA (SA) MMed (Anaes)(UCT), FRCPC

**Importance:** During the development of an enhanced recovery after cardiac surgery (ERACS) program, anesthesiologists at the Mazankowski Alberta Heart Institute (MAHI) incorporated erector spinae plane blocks (ESPBs) into their practice, however the impact of this intervention was uncertain.

**Objective:** To describe the current local perioperative pain management practice for cardiac surgery and determine whether the addition of ESPBs reduced time to extubation, post extubation pain scores, or opiate consumption.

**Design, setting and participants:** A retrospective chart review was performed of patients who underwent elective cardiac surgery at the MAHI between October 16th and November 24th 2020. Charts included in the study were those of patients who would have been included in an ERACS protocol. Surgical procedures included were elective coronary artery bypass surgery, valve replacement surgery, and other low risk procedures requiring cardiopulmonary bypass via median sternotomy.

**Exposure:** Preoperative ESP block compared to standard care (SC).

**Main Outcomes and Measures:** The primary outcomes were time to extubation, median peak and mean pain scores at 6 and 12 hours and cumulative postoperative opiate administration at 12 hours. Secondary outcomes included a description of intraoperative and postoperative analgesic use in the SC group to establish a baseline for further studies.

**Results:** The median time to extubation in the SC group was 324 minutes compared to 399 minutes in the ESP group ( $p$  0.602). Comparing the SC group and the ESP group, median peak pain scores at 6 and 12 hours were 6 (interquartile range (IQR) 5-7 and 5.25 (IQR 5-8) vs 6 (IQR 0-9) and 7.5 (IQR 5-8); and median mean pain scores at 6 and 12 hours of 6 (IQR 5-7) and 5.3 (IQR 5.7-7.5) in the SC group vs 2.5 (IQR 0-9) and 5.5 (IQR 2.7-7.3) with  $p$  values indicating a nonsignificant difference between the groups. The median intraoperative intravenous morphine equivalent dose in the SC group was 274 mcg/kg/hr (IQR 166 – 229).

**Conclusions and Relevance:** There was a trend to longer time to extubation in the ESP group although this difference was not statistically significant. There was also no significant difference in median peak and mean pain scores between the groups at 6 and 12 hours.



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#### **Brachial Plexus Injuries During Pediatric Cardiac Catheterization: A Quality-improvement Initiative to Reduce the Incidence of Injuries and Improve Post-procedure Detection**

Andrew Geisheimer, Konstantin Averin, Paula Holinski

**Background:** Pediatric cardiac catheterization is an invasive diagnostic or interventional procedure used to diagnose or treat children with congenital or acquired cardiac disease. Database registries rarely report brachial plexus injuries, and it is unclear whether this is a rare problem or simply underrecognized in pediatric patients. Anesthesiology positioning guidelines suggest positioning patients' arms with shoulder flexion less than 90 degrees and avoiding external rotation in order to reduce stretch and resultant injury on the brachial plexus, which cannot be achieved due to the technical requirements of cardiac catheterization.

**Local Problem:** Between 2015 and 2020, 7 patients were identified at Stollery Children's Hospital who had unilateral brachial plexus injuries following cardiac catheterization. The median age was 16.6 years (range 13.9-33.4 years) and injuries were identified post-procedure on the same or next day. All procedures were interventional: six for placement of Melody valves and one for angioplasty and stenting of aortic coarctation and subclavian artery stenosis.

**Methods:** This quality improvement project uses a Plan-Do-Study-Act approach to address brachial plexus injuries during cardiac catheterization. There are four separate interventions:

- Identify risk factors for injury through analysis of known cases
- Endeavour to prevent injuries by developing local positioning guidelines based on best-available literature, communication with other centres performing pediatric cardiac catheterization, and collaboration with physical medicine and rehabilitation
- Improve detection of injuries with specific screening one week post-procedure
- Develop a standard referral pathway for patients with suspected brachial plexus injuries for further evaluation and management

**Results:** This project is in the implementation phase: results of this project are not yet available. We anticipate that identifying known risk factors and optimizing positioning for these cases will reduce the incidence of brachial plexus injuries. This is a rare complication, and a difference may not be seen for a few years. There is also a possibility that improved screening may reveal more cases than initially detected, particularly in younger, non-verbal, or developmentally delayed patients.



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#### **ROTEM Indices Pre and Post Whole Blood Autologous Donation in Adult Cardiac Surgery Patients with Increased Perioperative Coagulopathy Risk: An Observation Cohort Study**

D. Vautour, W. Lam, A. Neufeld

**Importance:** Blood conservation strategies such as intraoperative autologous whole blood donation and use of viscoelastic hemostatic testing are utilized to reduce the incidence of allogenic blood transfusion. No study has investigated coagulation disturbances and correction from autologous whole blood transfusion measured by viscoelastic testing in cardiac surgery with increased perioperative risk of coagulopathy.

**Objective:** Determine the effect of intraoperative autologous whole blood on Rotational Thromboelastometry (ROTEM) indices.

**Design, Setting, and Participants:** The study was a retrospective, single-center academic hospital, observational cohort study from July 2020 to March 2021. Adult patients undergoing elective cardiac surgery requiring cardiopulmonary bypass (CPB) of prolonged duration (>120mins) and/or deep hypothermic circulatory arrest (DHCA) and receiving intraoperative autologous whole blood via acute normovolemic hemodilution were included.

**Exposure:** Serial viscoelastic hemostatic testing (ROTEM) occurred at the following junctures:

Time 1: Post induction of anesthesia, prior to procurement of autologous blood

Time 2: Post cardiopulmonary bypass, prior to autologous blood retransfusion

Time 3: Post intraoperative autologous blood retransfusion

**Main Outcomes and Measures:** Observation of differences in hemostatic parameters surrounding autologous blood donation including Coagulation Time (CT), Alpha Angle, Amplitude at 10 minutes (A10) and Maximum Clot Firmness (MCF).

**Results:** A total of 22 patients were involved in the study; Mean CPB duration was 181 minutes; 15 underwent DHCA for which the mean temperature was 20°C. Differences in ROTEM indices for CT, alpha angle, A10 and MCF were all statistically significant (i.e. demonstrated that ROTEM indices at time 1, 2 and 3 were different from each other). Correction of demonstrated coagulopathy by autologous whole blood transfusion was statistically significant for Coagulation Time. Only 2 patients (9%) required intraoperative allogenic blood transfusion.

**Conclusions and Relevance:** Perioperative coagulopathy induced by factors involved in cardiac surgery was demonstrated by serial ROTEM testing. Correction of this coagulopathy from autologous whole blood donation was most significant for deficiency in clotting factors. There was a low incidence of allogenic blood transfusion when utilizing autologous whole blood donation.



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#### Efficacy of Ketamine in Post Anesthesia Care Unit

Potvin C.A., Green, J., Dillane, D

**Introduction:** Ketamine is an NMDA antagonist with analgesic properties and is frequently used for pain control in the perioperative period. Its use has been validated to reduce postoperative pain when administered intraoperatively. Ketamine does not create respiratory depression, and this safety characteristic makes this molecule appealing for the reduction of pain and opioid consumption in the Post Anesthesia Care Unit (PACU). In the past literature, very little attention has been given to the use of ketamine in the immediate postoperative period, and results from previous randomized control trials are discordant.

**Methodology:** In order to assess ketamine efficacy for postoperative pain score reduction, we designed a single center observational study in our PACU of all adult patients post non-cardiac surgery with significant pain despite having received 0.1mg/kg or more of IV morphine equivalent (IV MoEq). The trial was registered with ClinicalTrials.gov Identifier: NCT04701008. Primary outcomes were pain reduction and opioid use 30 minutes after the administration of a ketamine bolus (up to 0.25mg/kg). Pain scores were measured using a Numerical Rating Scale (NRS) from 0-10. Secondary outcome was incidence of side effects from ketamine administration.

**Results:** Up to April 25th, 2021 74 patients met the inclusion criteria. NRS pain score reduction 30 minutes after IV ketamine administration was 2.8 +/- 1.8 (mean +/- S.D.) Pain scores prior to administration and 30 minutes post administration were 7.9 +/- 1.6 and 5.1 +/- 2.5, respectively. Mean ketamine dose in recovery room was 0.24 +/- 0.11 mg/kg. Mean IV MoEq received in the OR was 0.25 +/- 0.15 mg/kg. In PACU, patients received an IV MoEq dose of 0.14 +/- 0.05 mg/kg before receiving ketamine and 0.05 +/- 0.07 mg/kg after ketamine administration. 8 patients required a rescue nerve block. Side effects (dysphoria and hallucinations) were reported in only 2 patients (3%).

**Conclusion:** For adult patients with significant pain in PACU despite an adequate loading dose of opioids, ketamine seems to provide a clinically significant pain score reduction 30 minutes after administration. The incidence of side effects was low. Interim statistical analysis results will be presented on research day.



# UNIVERSITY OF ALBERTA

## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **Implementation of Accidental Dural Puncture Tracking and ED Presentation Algorithm to Improve Time to Anesthesiology Assessment and Care in Post-partum Women**

Adrian Koziak MSc., MD, FRCPC, Clinical Associate Professor, University of Alberta

Rebecca Entz MD, PGY2, Anesthesiology and Pain Medicine, University of Alberta

**Background:** Post-dural puncture headache (PDPH) is a potentially debilitating complication of epidural and spinal analgesia for women in the post-partum period and is associated with significant morbidity. It is a common occurrence with an incidence of approximately 1% in the obstetrical population and > 50% in those with recognized accidental dural puncture. Because of its relative frequency, many teaching tertiary OB centers have systems in place to identify patients with dural puncture during epidural to improve follow-up and flow through the emergency department to expedite anesthesia involvement in treatment.

**Objective:** The aim of this quality improvement project is to systematically identify patients who have experienced recognized or suspected accidental dural puncture during epidural and may be prone to PDPH, and improve both follow-up and the time to assessment and care from an anesthesiologist.

**Design:** This quality Improvement project utilizes a formalized documentation process in a designated PDPH binder to enable tracking of patients. An information handout for women receiving epidural analgesia peripartum will be provided to educate them about PDPH. It also involves an algorithm to expedite navigation through the emergency department, with the goal of timely involvement of the OB anesthesiologist to minimize time to expert assessment and treatment. Impact of the project will be captured using interim (6 mo.) and final surveys (1 year) of anesthesiology staff and residents as well as possible assessment of patient satisfaction in terms of follow-up and education.

**Conclusions:** This Quality Improvement project has recently begun in late April 2021. Data gathering will continue for a minimum of 1 year with interim assessment at 6 months. No conclusions can be drawn at this time.



# UNIVERSITY OF ALBERTA

## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### An Audit Of Difficult Airway Carts In Edmonton, Alberta

Zohreh Moazzeni MD, Yuqi Gu MD

**Introduction:** Airway complications are a leading cause of anesthetic morbidity and mortality, and equipment deficiencies are recognized as a major contributor. Immediate availability of organized difficult airway equipment is essential in all areas of the hospital that require emergent airway management. An audit of difficult airway carts was performed at our institution as part of a quality improvement project. The aim of this project was to identify variations in equipment organization, storage, and accessibility in difficult airway carts within Edmonton, Alberta.

**Methods:** A quantitative and qualitative audit was conducted on all the difficult airway carts in hospitals affiliated with the University of Alberta, Edmonton, using the standard set by Difficult Airway Society (DAS). Quantitative assessments of the carts were scored according to the presence or absence of essential equipment. Qualitative assessments of the carts were scored according to storage and accessibility. Audited locations included operating rooms (OR), intensive care units (ICU), coronary care units (CCU), and emergency room (ER) at University of Alberta Hospital, Royal Alexandra Hospital, Misericordia Community Hospital, and Grey Nuns Community Hospital. Each cart was scored according to the standardized checklist. The scores were converted into percentages and analyzed using descriptive statistics.

**Results:** We examined a total of 29 difficult airway carts. Seventeen in OR, 6 in ICU, 2 in CCU, 4 in the ER. In the quantitative part of the assessment, the median score of the equipment was 64%. The lowest score was 7% and the highest 93%. In the qualitative part of the assessment the median score was 62%, the lowest score was 23% and the highest 85%. There was significant heterogeneity in the content of the difficult airway carts between different locations within each hospital, and between different hospitals in the city.

**Interpretation:** This audit highlights areas for improvement in both the contents, organization, and maintenance of difficult airway carts in hospitals affiliated with the University of Alberta, Edmonton. The results can help inform future iteration of carts in order to ensure standardization, and ultimately improve patient safety.



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## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **A New Kid On The Block: A Before-after Cohort Study Of Continuous Erector Spinae Plane Blocks Following Posterior Spinal Fusion For Adolescent Idiopathic Scoliosis**

Allyson Farran MD, MSc1; Michael Little MD, FRCPC1; Eric Huang MD, FRCSC2; Kyle Stampe MD, FRCSC2; Florian Rudolph MD, FRCPC1; Mancho Ng MD, FRCPC1

Department of Anesthesiology and Pain Medicine, University of Alberta1  
Department of Surgery, University of Alberta2

**Background:** Posterior spinal fusion for adolescent idiopathic scoliosis can cause severe post-operative pain. These patients often have high systemic opioid requirements, which can result in a sequela of unwanted opioid-related adverse effects. The erector spinae plane block is a novel technique that blocks the dorsal and ventral rami of spinal nerve roots. The utility of this block in pediatrics is relatively new, and its efficacy in managing pain following surgery for scoliosis has only been described in a single case report.

**Aim:** To determine whether bilateral continuous erector spinae plane blocks, when compared to single-shot intrathecal morphine, reduces opioid consumption in the first 72 hours after posterior spinal fusion for adolescent idiopathic scoliosis. We also compared pain scores, ambulation milestones, and the frequency of opioid-related adverse effects between groups.

**Methods:** This was a before-after cohort study that compared a historical group of 31 consecutive patients receiving single-shot intrathecal morphine (5mcg/kg) to a prospectively matched cohort of 25 patients receiving bilateral continuous erector spinae plane blocks (bupivacaine 0.1%) initiated at the end of surgery. Both groups also received gabapentin (5mg/kg), ibuprofen (10mg/kg), and acetaminophen (15mg/kg), as well as opioids via patient-controlled analgesia.

**Results:** Patients receiving continuous erector spinae plane blocks used significantly less opioids compared to those receiving intrathecal morphine at 48 and 72 hours post-operatively (28.5mg±13.5 vs 43.6mg±20.2,  $p = 0.007$  at 48h; 29.5mg±13.6 vs. 47.9mg±23.0 at 72h,  $p = 0.002$ ). The continuous erector spinae plane blocks also had a lower incidence of nausea/vomiting (68% vs 90%,  $p < 0.05$ ), and pruritis (20% vs 52%  $p < 0.05$ ). There were no significant differences in numeric pain scores, ambulation milestones, or time to discharge.

**Conclusions:** When compared to the retrospective intrathecal morphine group, the use of continuous erector spinae plane blocks led to significant a reduction in opioid consumption. There was also a significant reduction in opioid-related side effects for patients receiving these blocks.



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## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **Intraoperative Temperature Monitoring and Management: A Quality Improvement Initiative**

Lauchlan Jankola, MD, Resident; Mancho Ng MD FRCPC

**Objective:** To use the Institute for Healthcare Improvement (IHI) Model For Improvement to assess our current local collective practice pattern in regard to perioperative temperature management (PTM) and evidence-based recommendations for the prevention of unintended perioperative hypotension (UPH). The aim is to reduce the local incidence of UPH to less than 5% through PTM and temperature monitoring over the course of 6 months and monitor for sustained improvement.

**Background:** UPH, also referred to as perioperative inadvertent hypothermia (PIH), is defined by a decrease in core temperature below 36 degrees Celsius at any point from 1 hour prior through 24 hours after anesthesia has been administered. UPH has been attributed to many adverse consequences including surgical site infections, poor wound healing, prolonged hypnotic and neuromuscular blocking agent drug effects, delayed post-anesthesia recovery, prolonged hospital length of stay, increased need for intensive care, increased likelihood in needing blood transfusion or blood products, higher rates of myocardial infarction and cardiac complications, increased mortality, and increased costs to the healthcare system. A number of studies confirm that active intervention and perioperative temperature management (PTM) play a significant role in preventing UPH, and support that the maintenance of normothermia reduces perioperative morbidity and adverse consequences. Evidence-based recommendations have been developed for the prevention of UPH including the most recent Canadian Anesthesia Society Guidelines, revised in 2020. This guideline includes the recommendation that “monitoring patient core temperature is strongly recommended during cases of general and neuraxial regional anesthesia lasting 30 minutes or longer. In the absence of surgical or patient indications for intraoperative hypothermia, active patient warming systems, control of the operating room ambient temperature, and other methods, should be used to target a central core temperature of 36 to 37 degrees Celsius.” Yet studies have demonstrated variable compliance with the use of temperature monitoring and PTM with the incidence of UPH ranging from 35 to 70% and more than 70% of patients not receiving appropriate temperature monitoring.

**Methods:** A retrospective chart review of electronic medical records of University of Alberta hospital surgical patients will be used to establish a baseline and subsequent improvement interventions using an audit form. The data collected will be used to assess the extent to which UAH practice are in accordance with CAS guidelines and the clinical impact of UPH on patients during their postoperative course, including the use of intraoperative temperature monitoring, the use of temperature management to mitigate intraoperative temperature loss, the documentation of UPH, and any documentation of adverse outcomes during a patient’s perioperative course that correlate with UPH. The IHI Model for Improvement will be used to implemented changes using



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PDSA cycles to measure for improvement over the course of 6 months. The primary outcome is the incidence of UPH, with secondary outcome measures assessing length of hospital stay, incidence of surgical site infections, major adverse cardiac events, stroke, delayed wound healing, duration of ICU stay, blood transfusion, mortality, and death.

**Ethics:** QI activities are not subject to institutional ethical review under Articles 2.1 and 2.5 of the Tri Council Policy Statement on Ethical Conduct for Research Involving Humans. However, the nature of the project is for presentation to colleagues, the institution and the department and is considered a “research project” prompting Research Ethics Board submission for determination of this requirement.



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### Department of Anesthesiology & Pain Medicine

#### **Local Adherence to Surgical Antimicrobial Prophylaxis Guidelines for Non-beta-lactam Intravenous Antibiotic Administration Timing and Appropriate Dosing in Edmonton Hospitals**

Presented by: Katherine Impey, BSc. MD

Additional Authors: Katherine Impey, BSc. MD, Katelynn Crick, BSc. Office of Lifelong Learning & the Physician Learning Program, Faculty of Medicine and Dentistry, University of Alberta; Lynora Saxinger MD. FRCPC. CTropMed, Division of Infectious Diseases, University of Alberta

**Introduction:** Surgical site infections (SSIs) are among the most preventable healthcare-associated infections and are a substantial burden to healthcare systems in terms of patient morbidity, mortality, and additional costs. The goal of surgical antimicrobial prophylaxis (SAP) is to prevent SSIs. Key elements in the appropriateness of SAP are type, timing and dosing. Current literature does support an increased risk of SSIs with inappropriate antibiotic timing and incorrect dosing when weight-based dosing applies. The Alberta Health Service 2018 SAP guidelines have specific recommendations according to patient, procedural and antibiotic factors and stipulates that it be given within 120 minutes prior to incision. Unfortunately, current literature also suggests that translation of guidelines into clinical practice remains problematic.

**Design and Methods:** In this prospective chart review, a previously collected data set for a beta-lactam SAP project was used. Adult and pediatric patients undergoing any surgical procedure at five sites throughout the Edmonton zone between June 4 and August 23 2019 were included to determine the frequency, timing and dosing of non-beta-lactam intravenous antibiotics.

**Results:** This study is currently in the data analysis phase.

**Conclusion:** Our aim was to determine the local adherence to administration times within 120 minutes prior to incision and whether the appropriate dosing was administered for non-beta-lactam Intravenous antibiotics.



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### Department of Anesthesiology & Pain Medicine

#### Comparing Vasopressors on Spinal Cord Perfusion in Acute Spinal Cord Injury

Authors: Jaeun Yang, Dr. Stephane Bourque, Dr. Ferrante S. Gragasin

**Introduction:** Acute spinal cord injuries can have long-lasting impact on a patient's physical and psychological wellbeing and have significant personal and societal costs. Therefore, the initial management of acute spinal cord injury (SCI) remains critical to improve neurological outcomes. The current guidelines recommend increasing spinal cord perfusion for neuroprotection during acute SCI, as measured by elevated mean arterial pressure (MAP). Yet, MAP is only a surrogate marker for spinal cord perfusion with various factors, in addition to blood pressure, affecting it. Therefore, this study will attempt to investigate and directly compare the effects of commonly used vasopressors on spinal cord perfusion in a rodent animal model. We hypothesize that there are no differences in commonly used vasopressive agents that increase MAP, and that MAP does not have a direct correlation with spinal cord blood flow, even in the range of autoregulation (i.e. MAP 60-160mmHg).

**Design & Methods:** Male and female Sprague-Dawley rats 3 months of age will be anesthetized and surgically instrumented with arterial and intravenous lines as well as a flow probe, which is able to detect changes in vascular blood flow of a single artery over time. The flow probe will be situated around the rodent-equivalent of the artery of Adamkiewicz in humans, which is a dominant thoracolumbar segmental artery that supplies the spinal cord. The rats will be divided into two groups. Group A "high blood pressure" group will target sBP>180mmHg using various pressors and examine the spinal cord blood flow. Group B "restorative blood pressure" will have hypotension induced with anesthetic agent (i.e. isoflurane) and vasopressors will be used to bring the sBP>120mmHg and spinal cord blood flow measured.

**Intervention(s) and Outcome Measures:** We will directly measure and compare the effects of various vasopressors, in particular norepinephrine, phenylephrine, vasopressin, dopamine, ephedrine, and epinephrine, on changes in blood flow to the spinal cord as it relates to changes in MAP.

**Conclusion:** To our knowledge, this will be the first study which attempts to directly measure spinal cord perfusion in response to infusion of various vasopressors. The current practice guideline for treatment of acute traumatic SCI is to elevate MAP >85mmHg for up to 7 days to reduce risk of secondary injuries, but the literature supporting these recommendations are weak. In this study, we will determine whether MAP, the most commonly used surrogate marker for cord perfusion, has a direct correlation with spinal cord blood flow, and how the pharmacology of various vasopressors affect spinal cord perfusion.



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## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **Pre-admission Clinic Review: How Do Patient and Procedure Factors Influence PAC Utility and End-outcomes?**

Drayton Trumble, M.D.1, Nirudika Velupillai, B.Sc.2, Wanhua Su, Ph.D.2, Victor Tran, M.D., FRCPC1.

1Anesthesiology and Pain medicine, University of Alberta, Edmonton, AB, Canada, 2Mathematics and Statistics, MacEwan University, Edmonton, AB, Canada

**Background:** Pre admission clinic (PAC) provides opportunities for patient assessments by an anesthesiologist prior to an anesthetic. Evidence based resources exist to help decide who should go to PAC. While helpful, they do not guarantee worthwhile, high-yield, or otherwise effective consultations.

**Methods:** Patients seen in PAC were identified in the preoperative area the day of surgery and offered a questionnaire. The anesthesiologist responsible for anesthetizing the patient was then approached with a questionnaire after their chart review.

**Results:** Eighty patients were enrolled, 41 female and 39 male. Surgical disciplines included thoracics (23, 29%), general surgery (14, 18%), urology (11, 14%), OHNS (10, 13%), bariatrics (9, 11%), orthopedics (7, 9%), and other (plastics [4, 5%], and gynecology [2, 3%]). Thirteen (16%) anesthesiologists did not review the consult prior to the case. Nine (11%) anesthesiologists indicated “no investigations” for patients with investigations ordered for the procedure. Only 44 anesthesiologists (55%) could confidently say PAC better prepared the patient. There was no correlation between surgical discipline and opinion of consult helpfulness or likelihood of reviewing lab investigations. Surgical discipline did correlate with likelihood of a consult being reviewed ( $p=0.047$ ), opinion of consult appropriateness ( $p=0.027$ ), and belief that the consult better prepared the patient ( $p=0.049$ ). Older patient age increased the likelihood of a consult being reviewed ( $p=0.014$ ) and opinion of patient preparation ( $p=0.020$ ). There was no correlation between surgical discipline and patient opinion of consult helpfulness, or time spent in hospital and overall satisfaction score. Younger patients who spent less time in PAC correlated with a reduction in self-reported pre-and-post PAC anxiety scores ( $p=0.041$ ). Finally, there was no correlation between an anesthesiologist opinion of patient preparation and patient satisfaction score.

**Conclusions:** Patient age and surgical discipline influence review rate and perceived utility of PAC consults. Patient selection should continue to be evidence based via patient and procedure factors, with more focus on who can foreseeably be better prepared by PAC. Patients considered unlikely to be better prepared by PAC do not appear to be at risk for lower patient satisfaction.



# UNIVERSITY OF ALBERTA

## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **Impact of Perioperative Nerve Block on Sevoflurane Consumption in Total Shoulder Arthroplasty**

Stephen Van Heyst<sup>1</sup>; Timur Ozelsel<sup>1</sup>; Rakesh Sondekoppam<sup>1</sup>; Vivian Ip<sup>1</sup>; Lora Pencheva<sup>1</sup>

<sup>1</sup>.Dept of Anesthesia and Pain Medicine, University of Alberta

**Introduction:** Regional anesthesia provides improved postoperative pain control and reduced opioid requirements, but exactly how it alters intraoperative volatile requirements is unknown. The objective of this study is to quantitatively measure average age-adjusted MAC of sevoflurane, intraoperatively, in patients receiving combined regional and general anesthetic.

**Design and Method:** A randomized double blinded control study will allocate volunteer patients into early intervention or delayed intervention groups. Patients in both groups will receive a preoperative interscalene nerve catheter. A 10 ml syringe of D5W and a 10 ml syringe of 1% Ropivacaine will be prepared and labelled pre-surgery or post-surgery depending on patient allocation. The pre-surgery syringe will be injected into the catheter immediately prior to sedation, and the second syringe will be injected at completion of surgery. Induction will be standardized. General anesthesia will be maintained at a starting age-adjusted MAC of 0.8 sevoflurane, and the patient will be monitored with Sedline, Masimo in combination with hemodynamics to ensure adequate sedation. If the patient's PSI drops below 25 or climbs above 50, MAC will be adjusted to ensure the patient is not over or under sedated. The same strategy will apply for changes in MAP or a heart rate 20% outside of baseline. No long acting opioids will be used during surgery. In Recovery, the patient will be monitored for sensory blockade, pain, opioid requirements, sedation level, and nausea. The patient will be questioned about awareness in Recovery and at 24 hours.

**Outcomes:** The normally distributed continuous data will be presented as a mean and standard deviation. For skewed continuous data, median and interquartile range will be presented. For parametric data comparison, student's t-test will be used with a significant difference set at 0.05%.

**Results:** The study is in the clinical phase, and has recruited 16 patients. 50 patients will be required to power the study to clinical significance. Initial results have not been analyzed.

**Conclusion:** The hypothesis that combined regional and general anesthetic significantly reduces volatile anesthetic requirements cannot be determined at the current stage. Completion of patient recruitment will be required to allow for full analysis of the data.



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## FACULTY OF MEDICINE & DENTISTRY

### Department of Anesthesiology & Pain Medicine

#### **An Anesthesiology Video-based Flipped Classroom Curriculum: Implementation And Assessment Of An Evidence Based Curriculum For Medical Students**

Reid McKibbin BSc, MD, PGY-3, Dr. Nirupan Vipulanathan MD, FRCPC

**Introduction (including objectives):** Flipped-classroom models have strong learning outcomes for lower and higher-order cognitive skills (O’Flaherty & Phillips 2015). This entails having lower order cognitive skills taught by text-based or video-based content, and higher order skills including application, discussed and reasoned with an expert in-person. There are however difficulties in implementing flipped classroom curriculums, including 1) finding tailored palatable resources for the current learner’s zone of proximal development, and 2) creating strong behaviour-based models for ensuring learners do pre-reading assignments (Abeysekera & Dawson 2014). Video-based content has a strong basis for enhancing medical education for a new generation of learners. This however requires careful consideration of evidenced-based principles for media creation, including: coherence and contiguity, segmenting content, and fostering generative processing with words, pictures, and conversational tone (Mayer 2010). Much of which is well delivered and has shown strong outcomes when khan-based video content is used. We have therefore designed an evidence based video curriculum to teach basic anesthesia concepts to medical students on anesthesiology electives/selectives. We have 2 parts to address in implementing the flipped classroom 1) video creation that meets the learners’ needs and 2) using behaviour models to ensure videos are properly utilized. We plan to address the second issue by using incentive models including: topic lists that must be discussed with staff after doing pre-reading, and open-book assessments to guide their own understanding of the subject. The object of this study is to evaluate the student curriculum engagement and satisfaction with this video resource, and learn how to further improve a medical student elective-based curriculum.

**Design and Methods:** Students on two week elective, and three week selective blocks will be provided with the new curriculum resources. Our resources include the video series, recommended reading, and topics which are to be discussed in the OR with staff. Student engagement will be tracked using a combination of video analytics and an end-of-rotation survey. Students will self-report completion of suggested reading and video material, and satisfaction with these resources. Additionally, students are provided with open-book exam questions to guide their learning.

**Outcome Measures:** The primary outcome is video engagement, quantified by percentage of video completion according to YouTube analytics and self-report on survey. The secondary outcome is curriculum satisfaction, as reported on survey.

**Results & Conclusion:** Pending